

Stormwater Managers Beware of Snake-Oil BMP's for Water Quality Management¹

Anne Jones-Lee, PhD and G. Fred Lee, PhD, PE, DEE

G. Fred Lee & Associates

El Macero, CA 95618

Ph: 916-753-9630

Fx: 916-753-9956

e-mail: gfredlee@aol.com

The US EPA's 1990 national urban area and highway stormwater runoff water quality management program has caused stormwater runoff water quality managers to have to give consideration to the development of management programs for chemical constituents in the stormwater runoff that exceed US EPA water quality criteria/state standards in the runoff waters. The regulations require that water pollution associated with stormwater runoff from urban areas and highways be controlled to the maximum extent practicable using best management practices (BMP's). Various professional organizations and some agencies, such as the Federal Highway Administration, have developed compilation of BMP's. Also, the WEF/ASCE as well as other organizations such as FHWA have developed guidance manuals that are supposed to provide guidance to stormwater managers on managing stormwater runoff caused pollution to the maximum extent practicable through the use of BMP's. However, a critical review of these guidance manuals as well as the BMP compilation documents show they do not provide the guidance that stormwater runoff water quality managers need to select appropriate BMP's to manage real water quality problems caused by chemical constituents in stormwater runoff from urban area streets and highways. This paper provides an introduction to the chapter that should have been included in the WEF/ASCE "Manual of Practice: Urban Runoff Water Quality Control" covering the approach that stormwater runoff water quality managers should use to determine whether there is need to control chemical constituents in stormwater runoff from urban areas and highways to a greater degree than is now occurring due to adverse impacts on the designated beneficial uses of the receiving waters for the runoff. The paper discusses the reasons why the conventional so-called stormwater runoff water quality BMP's, such as detention basins, various types of filters, grassy swales, etc., are not, in fact, BMP's that address real water quality problems-use impairments (pollution) of receiving waters for stormwater runoff from urban area streets, residential and some commercial areas, and highways.

The first step that a stormwater runoff manager should take in evaluating whether there is need for additional BMP's associated with stormwater runoff from a particular area is to assess whether the runoff associated constituents are causing pollution (water quality use impairment) in the receiving waters for the runoff. It is important not to make the mistake that is typically made of assuming that since stormwater runoff from urban areas and highways contains concentrations of some constituents above US EPA water quality criteria, that the exceedance of

¹Offered for presentation at the Water Environment Federation WEFTEC '97 National Conference that will be held in Chicago, IL in October 1997.

the water quality criterion/standard represents real water pollution. The nature of US EPA water quality criteria and state standards based on these criteria is such that chemical constituents in urban area and highway stormwater runoff can be well above the criterion/standard value without adversely impacting the real water quality/beneficial uses of the receiving waters for the runoff. The short-term episodic nature of stormwater runoff events coupled with the fact that, with few exceptions, many of the regulated chemical constituents in stormwater runoff, such as heavy metals and certain organics, occur in the runoff in particulate, non-toxic, non-available forms can allow significant exceedances of water quality criteria/standards to occur without adverse impacts on the designated beneficial uses of the receiving waters for the stormwater runoff. These exceedances reflect the overprotective nature of US EPA water quality criteria and state standards and are, therefore, administrative exceedances that do not reflect real water quality impairments. There is widespread recognition that the current regulatory approach which requires achieving US EPA water quality criteria/state standards in the receiving waters during a runoff event must be abandoned in favor of a more appropriate regulatory approach. The US EPA and some states are developing more appropriate approaches such as relaxation of meeting certain beneficial uses in the receiving waters during and following a runoff event in order to not cause an exceedance of a water quality standard.

One of the primary problems with current stormwater runoff water quality evaluation and management approaches is the use of conventional edge-of-the-pavement, end-of-the-pipe stormwater runoff monitoring, where a suite of conventional and Priority Pollutants are measured in the runoff waters. This type of monitoring has been conducted since the 1960's and produces data that shows that urban area and highway stormwater runoff contain chemical constituents and pathogenic organisms at concentrations in the runoff waters that could potentially be adverse to receiving water quality. However, this type of monitoring provides no reliable information on whether the regulated as well as unregulated constituents and pathogenic organisms in the runoff waters do, in fact, adversely impact real water quality in the receiving waters. In order to address this problem, the authors have developed an Evaluation Monitoring approach in which the stormwater dischargers, the regulatory agencies, and the users of the potentially impacted waterbody work together to define what, if any, real water quality problems are occurring in the receiving waters for the stormwater runoff. Where such problems are found, the cause of the problem is determined and the source of the constituents causing the water quality use impairment is identified through forensic analysis. The overall approach is a watershed based, water quality evaluation and management program that focuses the funds normally used for edge-of-the-pavement, end-of-the-pipe monitoring on highly selective studies to determine whether constituents in the runoff are present in toxic/available forms at sufficient concentrations to cause significant toxicity or other adverse impacts in the receiving waters for the runoff. The authors are now involved in an Evaluation Monitoring Demonstration Project devoted to Upper Newport Bay, Orange County, California water quality issues. The results of the initial phases of this project will be summarized in this paper to demonstrate how evaluation monitoring can be used to define whether stormwater runoff from a particular area causes real water quality use impairments for the runoff that would justify the development of either source control or structural BMP's of the type that are being used today.

The primary reason that conventional structural BMP's of the type listed and discussed in various compilation and guidance manuals are not real BMP's is that they are primarily directed toward controlling particulate forms of chemical constituents in stormwater runoff. However, it has been known since the early 1970's, although ignored by those who recommend detention basins, filters, etc. as BMP's for stormwater runoff, that particulate forms of chemical constituents are typically in non-toxic, non-available forms in the runoff waters. Further, they stay in these forms in the receiving waters for the runoff. The toxic, available forms of potential concern are the dissolved constituents. The US EPA finally acknowledged this situation with respect to certain heavy metals when, in 1995, as part of implementing the National Toxics Rule, it formally adopted ambient water dissolved metals as a basis for regulatory control for heavy metals. In time the Agency will follow similar approaches for many other constituents of concern for stormwater runoff from urban areas and highways. It is important to understand, however, that even dissolved forms of some constituents are not toxic due to chemical reactions such as complexation of metals that convert the ionic forms of the metal to a non-toxic form.

Increasing recognition is being given to the fact that in some areas unregulated chemical constituents such as some of the organophosphorus pesticides-diazinon- are causing stormwater runoff from urban areas and highways to be acutely toxic to aquatic life. This is a potentially significant problem in some areas such as north central California, where agricultural use of these pesticides and their airborne transport associated with the use causes rainfall and fogfall at considerable distances from the point of application to be toxic to some forms of aquatic life. There are situations where a stormwater runoff toxicity causes major rivers, such as the Sacramento River, to have toxic pulses due to diazinon, which last for several weeks each winter. This diazinon-caused toxicity is significantly adverse to aquatic life related beneficial uses of the Sacramento River and the Delta. Conventional BMP's such as the structural BMP's that are frequently used for removal of particulate forms of constituents, such as detention basins and filters, are ineffective in addressing a real potential significant water quality problem in stormwater runoff from urban areas and highways. The BMP that will need to be implemented for diazinon toxicity control will be to control diazinon use at the source where restrictions on the use of the pesticide that can lead to either its volatilization or presence in stormwater runoff in an area in toxic concentrations.

The conventional BMP's that are recommended by various professional organizations and agencies such as the WEF/ASCE soon to be released guidance manual will not be effective for controlling real water quality problems associated with stormwater runoff from urban areas and highways. Basically, these so-called BMP's can be characterized as snake-oil BMP's since they, like the cure-all elixir sold by the traveling salesman, are largely a waste of money in meaningfully addressing real water quality problems caused by urban area and highway stormwater runoff associated constituents. Detention basins, filters, grassy swales, and other conventional BMP's that are being recommended in professional organization manuals of practice fail to properly consider what has been known for many years in aquatic chemistry, toxicology, and water quality that technically valid, cost effective water quality management programs should focus on the evaluation and control of those constituents in the runoff waters that cause real water

quality use impairments in the receiving waters for the runoff. The brute force hydraulically-based BMP's that ignore aquatic chemistry and toxicology such as detention basins and filters should only be used where erosion that cannot be controlled at the source need to be controlled by settling or filtration. There are some who advocate that the use of particulate removal BMP's for stormwater runoff is justified based on the accumulation of the particulate associated constituents in the receiving water sediments and, thereby, cause problems for sediment quality. Those familiar with this topic know it would be rare that particulate heavy metals and many organics present in urban area and highway stormwater runoff would convert to toxic forms of the chemicals in the receiving water sediments. Site specific investigation of the receiving water sediment quality issues can be used to determine whether particulates in urban area and highway stormwater runoff lead to sediment quality problems in the receiving waters that are significantly adverse to the beneficial uses of these waters.

The authors have extensive experience in stormwater runoff water quality evaluation and management and have over the past 20 years published extensively on this topic. G. Fred Lee is president and Anne Jones-Lee is vice president of G. Fred Lee & Associates, a specialty environmental consulting firm located in El Macero, California.

References

- Lee, G.F. and Jones-Lee, A., "Appropriate Use of Numeric Chemical Water Quality Criteria," Health and Ecological Risk Assessment, 1:5-11 (1995). Letter to the Editor, Supplemental Discussion, 2:233-234 (1996).
- Lee, G.F. and Jones-Lee, A., "Independent Applicability of Chemical and Biological Criteria/Standards and Effluent Toxicity Testing," The National Environmental Journal, 5(1):60-63, (1995), Part II, "An Alternative Approach," 5(2):66-67 (1995).
- Lee, G.F. and Jones-Lee, A., "Stormwater Runoff Quality Monitoring: Chemical Constituent vs. Water Quality, Part I,II," Public Works, Part I 147:50-53 (1996), Part II 147:42-45, 67 (1996).
- Lee, G.F. and Jones, R.A., "Suggested Approach for Assessing Water Quality Impacts of Urban Stormwater Drainage," In: Symposium Proceedings on Urban Hydrology, American Water Resources Association Symposium, November 1990, AWRA Technical Publication Series TPS-91-4, AWRA, Bethesda, MD, pp. 139-151 (1991).
- Lee, G.F. and Jones-Lee, A., "Stormwater Runoff Management: Are Real Water Quality Problems Being Addressed by Current Structural Best Management Practices? Part 1," Public Works, 125:53-57,70-72 (1994). Part Two, 126:54-56 (1995).
- Lee, G.F. and Jones-Lee, A., "Water Quality Impacts of Stormwater-Associated Contaminants: Focus on Real Problems - Condensed Version," Proc. IWQA Specialized Conf. on Diffuse Pollution: Sources, Prevention, Impact and Abatement, Chicago, IL, pp. 231-240 (1993).